

Lesson Log-3/10/04

Day #4 Length of Class-83 min

What did you expect students to learn during the lesson? I expected students to differentiate between voluntary and involuntary reactions and how these both serve to allow the person to interact with their environment. A goal for today was to have students summarize the electrical conditions of resting and action potentials. Students needed to understand the role that neurotransmitters play in transmitting nerve impulses across a synapse. Students completed a "skills" lab activity from Lab Manual A that introduced the skills they needed to perform the inquiry lab. Students engaged in an inquiry lab activity which allowed them to observe the nervous system in action and measure reflexes. I expected students to design and conduct an experiment to test one factor that might be involved in affecting reaction time. By the end of class today students began to design and conduct their experiments in fulfillment of the inquiry lab.

Describe the learning activities and the use of resources to support students' learning of the lessons' main concept and/or processes. Class began with a review of transport across the cell membrane. The students reviewed the sodium-potassium pump. I asked students what the pump did. Several tried to answer and one was able to correctly recount how the pump is a membrane protein that moves sodium out of the cell and potassium inside. I displayed an image on the SmartBoard of the sodium-potassium pump and how it results in a net charge across the membrane. I had the students pass a lantern battery around while I drew a picture on the board of the battery and its terminals. The twelve-volt battery had a potential difference across the two terminals. I compared this with the SmartBoard image of the potential difference across nerve cell membrane. I had the students view a diagram in their books which shows an axon in both resting and action potential and demonstrates the charges across the membrane of the axon. We defined the terms action and resting potential in terms of what is happening to the axon membrane. At this point I redistributed the domino models and asked students to knock them all down to represent a neuron that has just conducted an impulse. I asked the students if the neuron could now conduct another impulse. Most agreed it could not. I asked the students what now had to happen for the neuron to conduct another impulse. We all agreed that the dominoes would have to be reset. I compared this to the resting membrane potential of an axon. After an action potential has been conducted, the membrane resets due to potassium flowing out of the

cell. I included these on my word wall of important vocabulary terms which I expect the students to learn. Neurotransmitters were covered, but very quickly. I displayed an image on the SmartBoard and identified where the neurotransmitters are found in a neuron. One of my students remarked that the neurotransmitter is like a football being passed.

Describe how you monitored students' learning and what you found about their

understanding of the lesson's main concepts. As with all of our classes I monitor student learning by asking questions to insure that students are getting the take home message. The students were quick to think of factors that could affect reaction time. During the pre-lab they indicated which factors they wanted to test during the lab activity. I walked around the room to insure students were safe and not violating the lab rules. All of the students were engaged in collecting the data. Once the inquiry lab was assigned, several student groups had difficulty identifying an experimental problem. I went group to group to assist them in thinking about the differences among the people in this room and realizing that these would be the only test subjects who would be available. This was usually enough to have the students come up with different factors to test for the comparison of reaction times.

Describe the instructional adjustments you made in response to your findings about

students' learning needs during the lesson. Initially I wanted to complete an activity that measures students' reaction time on-line on the "Neuroscience for Kids" website. Once in the computer lab, it became apparent that student computers did not support the activity. This was embarrassing for me, and I found out later that the students' computers have a lot of the multimedia features disabled to keep students from playing games. We returned to the classroom and completed another activity that I had prepared for a class that would not be able to visit the computer lab. This was a lesson I learned during year one, always have a backup plan! The domino models came in handy a second time to explain nerve impulse traveling in one direction only. The skills lab was modified so students did not have to answer the section labeled "Going Further." I wanted them to complete the skills lab quickly so we could get to the inquiry lab during today's class. I realized that I had planned to cover too much material in this unit. I will have to elaborate on neurotransmitters following this unit which will coordinate with neuromuscular junction. One of the problems encountered during the lab was that there are only three boys in this class and one was absent. Those groups that wanted to test boys' vs. girls' reaction time were limited in test subjects. I told them to proceed and to mention it in the

lab write-up. One lab group wanted to test reflexes and reaction time before and after lunch so I arranged it with their next block instructor to have them come back to class and finish collecting their data.

Chapter 35 Nervous System

Observing Nervous Responses

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Introduction

The nervous system is a series of conducting tissues that carries impulses to all parts of the body. Your nervous system initiates many types of reflex actions. When you touch a hot object, you immediately pull your hand away. You might be aware of this reflex action occurring, but you are unable to stop or control it.

How do reflex actions occur? When your hand touches a hot object, for example, heat receptors in the skin send an impulse to the muscles of the arm to contract. The impulse travels along the sensory neurons, to the spinal cord, across a synapse, and stimulates a motor neuron. The impulse leaves the spinal cord, passes back to the same nerve, and back to the arm muscles, causing them to contract and pull your hand away. This pathway is called the reflex arc. Because the reflex arc involves only the spinal cord and not the brain, a reflex action occurs in a matter of a fraction of a second, you are not able to control a reflex—it happens automatically.

In a nonreflex response, an impulse must travel to the brain. The brain interprets the stimulus and initiates an appropriate response. In this case, the time it takes to respond is measurably longer than the time required for a reflex arc. A person's reaction time can be measured by how quickly he or she can perceive a stimulus and then react to it. Driving a car and playing tennis are examples of activities in which reaction time is very important.

In this investigation, you will observe two reflex actions and measure your reaction time.

Problem

Can you control reflex actions? How can you measure reaction time?

Pre-Lab Discussion

Read the entire investigation. Then, work with a partner to answer the following questions.

1. What data will you record in Data Table 2?

Record in centimeters the position of your thumb and index finger. This is the distance the meter stick fell before you caught it.

2. What is another name for an involuntary or automatic response to a stimulus?

A reflex

3. What caution should you observe for shining the light?

The caution of not ~~aiming~~ shining the light directly into the persons eyes

Good point

4. Why do you put your elbow on the table when you are catching the meter stick?

You put your elbow on the table when you are catching the meter stick because you want to be able to move your elbow down when you go to catch the meter stick.

5. In Part A, why do you use an eyepatch instead of just closing your eye?

So you could directly cover up the eye from the light because if you didn't it might affect the experiment.

Materials (per group)

pen light
eye patch or eye cover
meter stick


Safety

This experiment involves physical contact. Avoid this experiment if a problem with the knee, eye, or hand exists. Note the safety alert symbol next to step 3 in the Procedure and review the meaning of the symbol by referring to Safety Symbols on page 8.

Procedure

Part A. Reflexes

1. Sit on a chair or stool.
2. Cross your left leg over your right.

-  3. Have a member of your group tap your knee firmly, slightly below the knee cap, with the side of his or her hand, as shown in Figure 1.
CAUTION: Be sure the knee is not hit hard. A firm, quick tap is sufficient. Avoid this experiment if a physical problem in the knee exists. Record your observations.

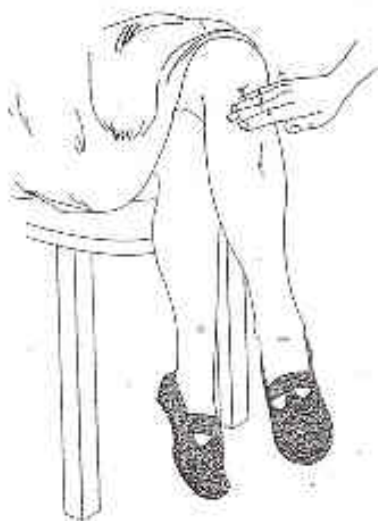


Figure 1

Name _____

Date _____

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4. Repeat steps 1 to 3. This time, try to stop your knee from jerking. Record your observations.
5. Reverse roles and repeat steps 1 to 4.
6. Sit on a chair or stool.
7. Close one eye and cover it with the eye patch. Keep the other eye open.
8. Have a group member shine the pen light close to the open eye for about 10 seconds. **CAUTION:** Do not shine light directly into the eye.
9. Quickly remove the patch from the other eye.
10. Have a group member observe what happens to the pupils of both the eye exposed to light and the eye that remained in darkness. Record the observations in Data Table 1.

Data Table 1

Stimulus	Observations
Light	The pupil of the eye that was in the light got smaller.
Dark	In the dark the pupil remained the same, but looked way bigger than the one in the light.

11. Reversing your roles, repeat steps 6 to 10.

Part B. Reaction Time

1. Rest your elbow on a table and extend your arm over its side as shown in Figure 2.

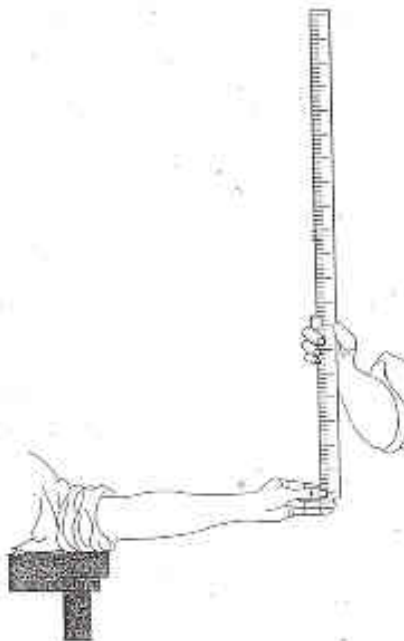


Figure 2

- Have a group member hold a meter stick in the air, with the 0-cm line between the thumb and index finger of your extended hand.
- Have the group member drop the meter stick without advance notice. Try to catch it between your thumb and index finger as quickly as possible.
- In Data Table 2, record in centimeters the position of your thumb and index finger. This is the distance the meter stick fell before you caught it.
- Repeat steps 2 to 4 three times.

Data Table 2

Trial	Distance (cm)
1	7cm
2	26cm
3	7cm
4	10cm

A STUDENT'S NAME WAS HERE

Analysis and Conclusions

- Observing** What happened to your knee when it was tapped?

I got a little reaction in the left knee but I got no reaction at all in the right. So for my right leg I did a little trick where I put my hands together. Then when I felt the hammer hit my knee I would pull my hands apart.

- Inferring** Could you prevent the knee jerk or the pupil contraction?

Explain your answer.

I think in some ways I could prevent the knee jerk if I thought about stopping my knee from moving because my brain would over-ride what my knee would do because you can control your knee from your brain, but you can't control the pupil contraction.

- Observing** What happened to the pupil of the eye that was close to the light?

The pupil got a lot smaller.

- Inferring** How does the amount of light affect the pupils?

When there's more light the pupil tends to get smaller while, when there was less light the pupils remains the same, or doesn't get that small.

- Classifying** Is catching the meter stick a voluntary reaction or a reflex? Explain your answer.

It's a voluntary reaction because you have to think about catching the meter stick through both your pointer and index finger, it's not just something that would happen automatically.

- Calculating** What was the average distance the meter stick fell in your four trials?

My average distance was 39.75 cm

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____ Date _____

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7. **Comparing and Contrasting** In catching the meter stick, were your reactions faster or slower than those of your classmates? How do you know?

My reactions were slower than most of my classmates. I know because I was going around and seeing everyone else's reaction times and mine seemed to be one of the slowest.

8. **Classifying** From your observations, how would you classify the knee-jerk and the pupillary response? Explain your reason.

I would explain the knee-jerk as a voluntary reaction because it can be controlled by your brain in a way and the pupillary response is a reflex because there's no way you can control your brain how big or small your pupil gets.

9. **Drawing Conclusions** Suggest some possible ways that reflex arcs could be advantageous to a species.

Take for instance animals, if they didn't have reflex arcs then they wouldn't be able to escape danger or they wouldn't be able to go after their food. With our reflexes they are able to survive out in the wild.

Going Further

Do the senses of sight, smell, hearing, taste, and touch also affect our reflex actions? Why does your mouth water when you are hungry and see a picture of a delicious meal? Ivan Pavlov, a Russian biologist, carried out many experiments on conditioned reflexes. What are conditioned reflexes? How are stimulus and response related? Use resources in your school library or on the Internet to find out more about conditioned reflexes. Share your findings with the class.

→ Actually knee jerk and pupillary response are involuntary. Both serve to protect you, without having to "think" about it.